Global Hydrology Resource Center

Data User Guide

GPM Ground Validation SEA FLUX ICE POP

Introduction

The GPM Ground Validation SEA FLUX ICE POP dataset includes estimates of ocean surface latent and sensible heat fluxes, 10m wind speed, 10m air temperature, 10m air humidity, and skin sea surface temperature in support of the International Collaborative Experiments for Pyeongchang 2018 Olympic and Paralympic Winter Games (ICE-POP) field campaign in South Korea. The two major objectives of ICE-POP were to study severe winter weather events in regions of complex terrain and improve the short-term forecasting of such events. These data contributed to the Global Precipitation Measurement mission Ground Validation (GPM GV) campaign efforts to improve satellite estimates of orographic winter precipitation. This data file is available in netCDF-4 format from September 1, 2017 through April 30, 2018.

Citation

Roberts, Jason. 2020. GPM Ground Validation SEA FLUX ICE POP [indicate subset used]. Dataset available online from the NASA Global Hydrology Resource Center DAAC, Huntsville, Alabama, U.S.A. doi:
http://dx.doi.org/10.5067/GPMGV/ICEPOP/SEAFLUX/DATA101

Keywords:

NASA, GHRC, ICE-POP, GPM GV, South Korea, SEA FLUX, ocean surface turbulent fluxes

Campaign

The Global Precipitation Measurement mission Ground Validation (GPM GV) campaign used a variety of methods for validation of GPM satellite constellation measurements prior to and after the launch of the GPM Core Satellite, which launched on February 27, 2014. The instrument validation effort included numerous GPM-specific and joint agency/ international external field campaigns, using state of the art cloud and precipitation observational infrastructure (polarimetric radars, profilers, rain gauges, and disdrometers). These field campaigns accounted for the majority of the effort and

resources expended by the GPM GV mission. More information about the GPM GV mission is available at the PMM Ground Validation webpage.

The International Collaborative Experiments for Pyeongchang 2018 Olympic and Paralympic Winter Games (ICE-POP) field campaign took place during the 2018 Pyeongchang Winter Olympic and Paralympic Games in South Korea (Figure 1). This field campaign was a collaboration between various international organizations to study and improve the understanding of severe winter weather events, specifically in regions of complex terrain. Researchers sought to improve short-term predictions of orographic winter precipitation and test model based predictions by studying various aspects of winter weather including snowfall physics, winds, visibility, and cloud structure. The Winter Games, with their need for short-term forecasting of rapidly developing winter weather in a mountainous location, provided the perfect test environment for this study. Data was also collected to validate and improve satellite estimates of orographic winter precipitation in support of the GPM GV campaign. More information about the ICE-POP field campaign can be found on the PMM ICE-POP webpage.

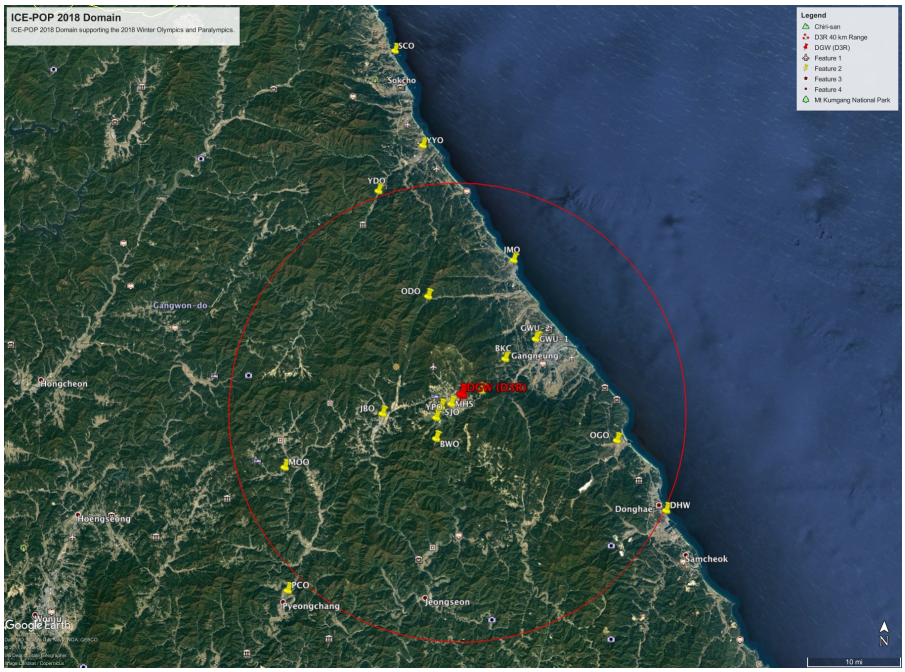

Figure 1: ICE-POP Field Campaign Domain Area (circled in red) on the east coast of South Korea (Image source: GPM ICE-POP 2018 webpage)

Product Description

There are multiple ongoing efforts to develop satellite-based estimates of the ocean surface turbulent fluxes and associated near-surface properties. These efforts principally rely on the application of microwave imager observations capable of providing information on near-surface wind speeds, humidity, and to a lesser extent temperature. The SeaFlux-Climate Data Record (Clayson and Brown, 2016; hereafter referred to as SearFluxCDR) was recently produced and provided the first 3-hourly varying ocean climate data record of air-

sea fluxes. It relied on the use of SSM/I and SSMIS passive microwave imager observations to retrieve near-surface winds, humidity, and temperature with a neural network following Roberts et al. (2010). Diurnally varying sea surface temperature (SST) were provided by superimposing a diurnal cycle onto the foundation SST provided by the NOAA Optimally Interpolated Sea Surface Temperature (Reynolds et al. 2007). Despite the use of intercalibrated brightness temperatures, subsequent analyses revealed inconsistencies in the SeaFluxCDR parameters between sensors, especially in latitudes poleward of 40°. Multiple improvements have been undertaken to the SeaFluxCDR that have resulted in a new dataset, SeaFluxV3. More information about these improvements can be found in the *Algorithm* section of this user guide.

The International Collaborative Experiment for PyeongChang Olympic and Paralympics (ICE-POP) coordinated numerous international modelling and observational groups to observe and model weather over the Korean peninsula in support of the 2018 Winter Olympic games. More information about the algorithm to create this product subset can be found in the *Algorithm* section of this user guide.

The ICE-POP subset includes ocean surface latent and sensible heat fluxes, 10m wind speed (actual, not equivalent neutral), 10m air temperature, 10m air humidity, and skin sea surface temperature. The data has been conservatively remapped onto a 0.25°x0.25° equal-angle grid over the domain covering 98.5E to 177.5E and 8.5N to 54.25N. Data is produced at hourly temporal resolution. The subset data is generated for the period of September 1, 2017 through April 30, 2018.

Investigators

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Data Characteristics

The GPM Ground Validation SEA FLUX ICE POP dataset contains a data file in netCDF-4 format at a Level 4 processing level. More information about the NASA data processing levels are available on the EOSDIS Data Processing Levels webpage. Table 1 shows the characteristics of this dataset.

Table 1: Data Characteristics

Characteristic	Description
Model	SEA FLUX
Spatial Coverage	N: 54.25, S: 8.5, E: 177.5, W: 98.5 (West Pacific Ocean)
Spatial Resolution	0.25 degrees
Temporal Coverage	September 1, 2017 - April 30, 2018
Temporal Resolution	Monthly -> Annually
Sampling Frequency	1 hour

Parameter	Latent heat flux, specific humidity of air, sensible heat flux, sea surface temperature, air temperature, and wind speed
Version	1
Processing Level	4

File Naming Convention

The GPM Ground Validation SEA FLUX ICE POP data are in the naming convention below.

Data files: SeaFluxV3_ICEPOP_0.25x0.25.nc4.gz

Table 2: File naming convention variables

Variable	Description
.nc4	netCDF-4 format
.gz	Gzipped data file

Data Format and Parameters

The GPM Ground Validation SEA FLUX ICE POP data file is in netCDF-4 format. There are 13 fields in the data file including latent heat flux, specific humidity, sensible heat flux, sea surface temperature, and wind speed.

Table 3: Data fields in the SEA FLUX netCDF-4 data file

Variable	Description	Unit
area	Solid angle subtended by gridcell	steradian
lat	Latitude	Degrees North
lat_bnds	Gridcell latitude interfaces	-
lhf	Latent Heat Flux. Positive upward (out of ocean)	W/m^2
lon	Longitude	Degrees East
lon_bnds	Gridcell longitude interfaces	-
obsflag*	Flag for land/ice/observed/unsampled: 0 = Land 1 = Ice 2 = Unsampled 3 = Observed	-
qair_10m	Specific humidity of air at 10m	g/kg
shf	Sensible Heat Flux. Positive upward (out of ocean)	W/m^2
sst	Skin sea surface temperature at 1m	Degrees C
tair_10m	Air temperature at 10m	Degrees C
time	time	Seconds since 1970-01-01
wspd_10m	Wind speed at 10m	m/s

*Those pixels which are unsampled and/or observed both represent the final value of the analysis after running the Kalman filter. An identification of "observed" indicated that an actual observation was available at that location and time. Note that technically a Kalman smoother has been used so that neighboring

observations in time (i.e. before and after) can impact the analysis for hours which were not sampled (i.e. "Unsampled").

Algorithm

Retrievals have been developed using the latest Global Precipitation Measurement mission Level 1C intercalibrated brightness temperature record (Berg et al., 2018). The nonlinear neural-network based retrievals of wind speed, air temperature, and air specific humidity (Roberts et al., 2010) were updated to include a priori information on water vapor and atmospheric temperature structure using MERRA-2, a long-term record of global atmospheric analyses, beginning in 1980, to address regional biases found in Roberts et al. (2019). The collection of microwave imagers has extended beyond SSM/I and SSMIS to include TMI, AMSR-E, AMSR-2, and GMI. Each sensor was further adjusted to account for earth incidence angle variability. Near-surface retrievals from each sensor were further intercalibrated using a quantile-matching approach using collocated estimates; the intercalibration was chained backwards in time using GMI as the primary reference. Diurnally varying sea surface temperatures generated for the SeaFlux-CDR record were applied to the OISST for all surface flux computations using the COARE-3.5 (Edson et al., 2013) algorithm. The new approach is developed to generate hourly estimates of near-surface parameters — SST, 2m air temperature, 2m humidity, and 10m wind speed on a global, 25km equal area scalable earth (EASE) grid. To address data gaps, a Kalman Filter has been developed to generate a gap-free analysis over the ice-free ocean. The satellite observations, properly weighted for their uncertainties are blended with model information from MERRA-2.

The International Collaborative Experiment for PyeongChang Olympic and Paralympics (ICE-POP) coordinated numerous international modelling and observational groups to observe and model weather over the Korean peninsula in support of the 2018 Winter Olympic games. Observations included not only precipitation from ground- and space-based radars, but also a request for satellite-based turbulent fluxes. Prior to and during this field campaign, a near-real-time product was developed that used the available GPM L1C microwave imager observations that are generated to support the Integrated Multi-satellitE Retrievals for GPM (IMERG) data product.

The near-surface wind speed, humidity, and temperature were estimated using a variant of the Roberts et al. (2010) retrieval approach but tuned for application to the more recently available sensors. After the official campaign, lessons learned from this effort together with those from the previous development of the SeaFluxCDR were taken into account in the development of SeaFluxV3. To support further evaluation of model forecasts and other datasets collected during ICE-POP, a subset of the SeaFluxV3 dataset has been made over the regional domain.

More information on the algorithm used to create this data product can be found at Edson, 2015 and COARE-Met Flux Algorithm.

Quality Assessment

A Kalman smoother has been used so that neighboring observations in time (i.e. before and after).

Software

No software is required to view the netCDF-4 data file; however, Panoply can be used to easily view this file.

Known Issues or Missing Data

Since Kalman smoother was used on the data, it can impact the analysis for hours which were not sampled (i.e. 'Unsampled' in the *obsflag* variable).

References

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Related Data

All other dataset collected as part of the IMPACTS campaign are considered related and can be located by searching the term "IMPACTS" in the GHRC HyDRO2.0 search tool.

Contact Information

To order these data or for further information, please contact:

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Created: May 22, 2020